

Annual Studies Plan

FY 2002-2004

MINERALS MANAGEMENT SERVICE

Environmental Studies Program



Gulf of Mexico OCS Region
Environmental Sciences Section

October 2001
Final

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SECTION 1. Programmatic Overview

1.1. Introduction to the Region

In managing Outer Continental Shelf (OCS) activity, the Minerals Management Service (MMS) has two core responsibilities, safe offshore operations and environmental protection. Our safety goal is to ensure incident free minerals exploration and development on Federal Offshore Leases. Our environmental responsibilities are to ensure that all activities on the OCS are conducted with appropriate environmental protection and impact mitigation.

The MMS New Orleans Regional Office conducts all leasing and resource management functions on the Outer Continental Shelf (OCS) for the Gulf of Mexico and the Atlantic OCS areas, a total of 415 million acres in seven planning areas (see map in Section 1.2). The Gulf of Mexico OCS Region's (GOMR) three planning areas along the Gulf Coast contain 39 million acres under lease (as of 02-01-2001). There are 3,981 offshore production platforms active in the search for natural gas and oil on the Gulf OCS (as of 02-01-2001); these contribute significantly to the Nation's energy supply. Ten oil and gas lease sales were held in the Atlantic between 1976 and 1983. Forty-seven exploratory wells were drilled. Only five wells discovered hydrocarbons. These five wells were offshore New Jersey and were abandoned as non-commercial.

The Minerals Management Service (MMS) Environmental Studies Program (ESP) was established in 1973 as a means to gather information to support decision making for offshore oil and gas leasing. The program (then under the Bureau of Land Management) evolved with changes in the geographic areas of concern, in environmental issues, and in study priorities and policies. In 1994, the MMS Atlantic OCS Regional Office was closed and its responsibilities transferred to the Gulf of Mexico Region (GOMR). In the GOMR, the ESP addresses issues from prelease through postlease operations. In the Atlantic Region, the ESP has been limited to prelease descriptive and process-type investigations since there has been no production in that area.

The Gulf of Mexico is anticipated to remain the Nation's primary offshore source of oil and gas. Initiatives to emphasize the use of "environmentally friendly" natural gas further promote the production from the Gulf's gas fields. Advances in offshore technologies (e.g., directional drilling; deepwater structures such as sub-sea completions, spar, and tension-leg platforms; sub-salt prospecting; three-dimensional geophysical profiling; and down-hole instrumentation) ensure that exploration and development will continue in the Gulf for decades to come.

In 1992 the MMS entered into a partnership with the Louisiana State University (LSU) to establish the first Coastal Marine Institute (CMI). This partnership was developed as part of an initiative to cultivate new State-Federal cooperative agreements on environmental and socioeconomic issues of mutual concern. These projects are designed to help answer questions regarding the potential impacts from oil and gas and marine minerals activities.

The establishment of the Biological Resources Division (BRD), a division of the U.S. Geological Survey, in 1996, provided the MMS with new opportunities for partnership in biological

research. The BRD has procured and is conducting several studies for the GOMR. This partnership will continue and several projects are described in this plan anticipating the involvement of the BRD.

Because there has been a dramatic increase in deepwater oil and gas activity in the Gulf of Mexico, the MMS sponsored a deepwater workshop in April 1997. Conducted under a cooperative agreement with LSU, the workshop focused on physical oceanography and the environmental and sociological sciences. The recommendations and issues identified in the workshop proceedings (Carney, 1997) are being used to design the studies needed by the MMS in the preparation of environmental assessments, other NEPA documents, and deepwater regulations to oversee oil and gas activities. A follow-up workshop to discuss the results of these studies is planned for Spring 2002.

1.2. Map of the Planning Area



1.3. Projected OCS Activities

1.3.1. Gulf of Mexico Region

Since the Gulf of Mexico Region is the most active OCS area, all activities associated with oil and gas exploration and production in U.S. are occurring. These activities

include leasing, exploration, development, removal of platforms, and laying of pipelines. A new five-year (2002 – 2007) environmental assessment is currently being written which will include one lease sale per year in each of the central and western planning areas. The first lease sale in the eastern planning area since 1988 is planned for December 2001. Three additional lease sales are proposed within the eastern planning area during the following five years in the same area as Lease Sale 181 and two others are proposed for areas south of the Lease Sale 181 area.

The number of rigs drilling in deepwater in the Gulf of Mexico rose to a record high of 40 in December 2000. Seven of the 40 wells were being drilled in water depths greater than 1500 m. The success of recent discoveries and the higher price of oil and gas continue to support increasing future activity in deepwater. In addition, 23 structures and 53 subsea completions are in place presently and more are expected. Exploration continues on the shelf as a result of improved seismic data and drilling capabilities.

The number of production platforms should continue to increase in deepwater while the continental shelf should remain static or decrease. Approximately 150 structures are installed annually on the shelf and 140 structures are removed. Pipeline segments are installed between connections and can be any length. Last year, the installation of approximately 400 pipeline segments was approved.

Recently, an Environmental Impact Statement (EIS) was completed on the use of Floating Production, Storage, and Offloading Systems (FPSO). The system allows for the storage of oil on the drill ship and the transfer of the oil to other vessels for transport to shore. This eliminates the need for pipelines, emplacement of a “permanent” structure, and removal of the structure. The use of FPSOs in the Gulf of Mexico is pending the Record of Decision on the EIS.

1.3.2. Atlantic Region

The last lease sale within the Atlantic Region occurred in 1983. On November 17, 2000, the interests in the last remaining 8 natural gas and oil leases active in the Federal waters offshore North Carolina were relinquished. There are now no oil and gas leases in existence off the Atlantic Coast. However, the recent surge in energy prices and predicted decline in natural gas supply may result in future leasing activity.

1.4. Identification of Information Needs

With the dramatic increase in offshore oil and gas activities in the Gulf of Mexico, environmental and socioeconomic information needs have increased as well. The Gulf of Mexico Region has approximately 100 ongoing studies divided among all areas of interest. We are proposing studies in the following topics for the next fiscal year to meet our information needs.

1.4.1. Physical Oceanography

The Region has already conducted numerous studies along the continental shelf. We have recently held a workshop to plan the acquisition of information in deepwater. An exploratory study is in the procurement process and results from the study will be used to plan future research in FY2004 and beyond. Of interest is the recent observation that Sperm Whales congregate along the 1000-meter isobath. This may be in response to localized upwelling or some other physical oceanographic process. Understanding where and why sperm whales aggregate will better enable MMS to protect them from oil and gas activities.

Recently completed studies have increased our database on physical oceanographic parameters in the northeastern Gulf of Mexico, in particular the DeSoto Canyon. The data can now be used to advance the understanding of physical oceanographic processes along the slope and shelf through application of numerical modeling techniques.

1.4.2. Atmospheric Sciences

Two major air emissions data collection activities are presently underway. One is in the Breton Sound area and one that is Gulfwide. Some modeling efforts are also planned, but with the presence of several large cities along the Gulf Coast, Corpus Christi, Houston, New Orleans, Mobile, and Pensacola, the contribution of air emissions from offshore oil and gas activities to ozone compliance is a concern. Once the data is collected from the above efforts, it will be necessary to model the ozone contribution from offshore activities. As a part of modeling efforts meteorological information is required, and at this time meager for the Gulf. We are considering the use of satellite imagery to enhance the data set.

A recent meeting with industry has resulted in a proposed air quality workshop to discuss the air quality program and future methods of collecting inventories and modeling data. The workshop is planned to occur in Spring 2002.

1.4.3. Fates and Effects

In the mid-1970s, the first major offshore environmental survey in the Gulf of Mexico was conducted in response to questions about the effects of oil and gas activities on the continental shelf. This study, "MAFLA", examined physical, chemical, and biological parameters along the Mississippi, Alabama, and Florida shelf. Parts of the Mississippi and Alabama shelf were revisited in the late 1980's for similar analyses as part of "MAMES". We are proposing a third visit to the same areas as examined under "MAFLA" with the intent to investigate the environmental effects of increased activities along the shelf over the past 25 years.

The Gulf of Mexico is a marginal sea with depth of 3500 meters and a sill depth of 1800–2000 meters. The isolated basin has an oxygen concentration of approximately 5-ppm. The processes replenishing the oxygen on the deepwater are not well understood. With increasing activity in deepwater and the resulting discharge of organic material, the potential for localized hypoxia exists. An understanding of the time scales for the

processes is crucial in understanding the effects of deepwater activities. We are proposing a study to increase the understanding of the replenishment of oxygen in the deep Gulf.

1.4.4. Biology

A major study of the deep-sea benthic community is in the second year and has already yielded interesting information about the trends and distribution of benthic fauna. We also support a program to monitor the Flower Gardens, which we are proposing to continue for four more years. No new information needs have been identified for FY 2002.

1.4.5. Protected Species

A major interagency study was conducted with the National Marine Fisheries Service (NMFS) during calendar year 2000, which resulted in the observations of Sperm Whales congregating along the 1000-meter isobath. We are continuing to fund this endeavor for two more years through an interagency agreement. In addition, we will also begin conducting research into the acoustic effects of exploration on marine mammals in cooperation with NMFS. These two studies will meet our information needs for the next fiscal year.

1.4.6. Social Sciences and Economics

The Gulf of Mexico Region has a very active program in social sciences and economics. During FY 2002, the focus will be on studies presently underway. However, increased interest in the Atlantic Region with the potential of developing of natural gas resources in the next ten years has resulted in our proposing a study of the infrastructure presently in place. The focus of this study will be the New Jersey coast, but it will include several neighboring States.

Under NEPA, it is the responsibility of MMS to protect artifacts on the seafloor, specifically shipwrecks. There are numerous possible WWII freighter and tankers that have been identified in remote sensing records. We are proposing to further investigate and identify these shipwrecks and explore the possibility that they may serve as biological habitat in deepwater.

We are initiating a study of the history of oil and gas development on the Gulf OCS that will include oral histories collected from pioneers in the industry. Since the methodology pilot study is in the process of being procured, and if the results are successful, we are proposing a larger gathering of information that will lead to a book about the industry.

1.4.7. Gas Hydrates

Interest in gas hydrates has waxed and waned over the past 30 years. With the recent spike in natural gas prices and interest in alternative fuel sources, interest is again focused on gas hydrates. If hydrates do become an economically viable resource, environmental assessments will require an understanding of the location and distribution of the resource.

We are proposing two studies to further investigate hydrates in the Gulf of Mexico. Hydrate outcrops are unique to the Gulf of Mexico and may be indicators of a significant source of natural gas and may represent a recoverable resource. We are proposing a joint venture with other agencies to investigate the outcrops with the submersible Alvin. Below the surface, hydrates may also be present but not visible in standard geophysical data because of the complex geological nature of the Gulf. To further evaluate the extent of hydrates at depth, a joint venture with other agencies in conjunction with the Ocean Drilling Program is proposed.

Evaluations of deepwater blowouts have raised the question of whether the formation of hydrates would affect the rising oil plume. A recent field experiment did not result in observations of hydrate formation. One explanation is that nucleation is a critical step in hydrate formation, but little is understood about the nucleation process. We are proposing a laboratory study to investigate and model the nucleation process of hydrate formation.

1.4.8. Other Studies

As a result of the studies, a tremendous amount of information is gathered. The MMS has developed a Coastal and Offshore Information System (CORIS) to organize the information and make it available to the users. Information from past studies still needs to be incorporated into the system. We are proposing a study to do this.

During the preparation of Environmental Impact Statements, the risks or impacts of activities associated with oil and gas extraction must be evaluated. We are proposing several studies to assist with the estimations of spill occurrences and support vessel usage. We are also proposing a workshop on weathering of spilled oil in conjunction with NOAA.

SECTION 2.

2.1. Introduction

The following sections focus on the proposed studies for FY 2002, FY 2003, and beyond. Most of the ongoing studies in the Gulf of Mexico Region can be found on the web at:

<http://www.mms.gov/eppd/studies/index.htm>.

Additional information about recent MMS funded deepwater research, in particular research cruises, can be found at:

<http://www.gomr.mms.gov/homepg/regulate/envIRON/deepenv.html>.

2.2 Profiles of Regional Studies Proposed and on the FY 2002 NSL

Gulf of Mexico Region Proposed Studies and Ranking for FY 2002

Studies Plan Page #	**	Title	Regional Rank ***
11	PS	Explosive Removal of Offshore Structures: Information Search and Synthesis	1
13	PS	Pressure Wave and Acoustic Properties Generated by the Explosive Removal of Offshore Structures: Potential Effects on Protected Species	2
15	BIO	Long-term Monitoring at the East and West Flower Garden Banks \$400K	3
17	OT	Incorporating Survey Information from MMS Studies into CORIS \$50K	4
19	OT	<i>Deepwater Program:</i> Understanding the Processes that Maintain the Oxygen Levels in the Deep Gulf of Mexico	5
21	SE	History of Offshore Oil Development in the Gulf of Mexico, Phase II: Research and Synthesis	6
** PO = Physical Oceanography FE = Fate & Effect BIO = Biology PS = Protected Species SE = Social & Economic OT = Other *** Rank 1 = highest			

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDY PLAN FY 2002-2004

Region: Gulf of Mexico Region

Planning Area(s): Gulfwide

Type: Competitive Procurement

Title: Explosive Removal of Offshore Structures Information Search and Synthesis **Cost Range** (in thousands): \$200 to \$300 **Period of Performance:** FY 2002

Description:

Background Approximately 4,000 oil and gas structures exist on the U.S. Outer Continental Shelf (OCS). Within one year of lease termination, the MMS requires that structures be removed from the OCS. The most common method for removing structures involves severing them in sections and lifting them from the water with a crane. Explosives are usually used to cut structures below the waterline. MMS requires that structures be severed at least 15 ft. below the mudline. Explosive removals of offshore structures historically occur in shallower waters of the OCS. However, industry is currently installing structures on the continental slope in search of new and untapped petroleum reservoirs. Eventually, these structures will have to be removed. Although their removal will most likely involve the use of explosives, little information exists regarding how deepwater structures can or will be removed.

The detonation of explosives underwater has resulted in the “take” of protected species, such as marine mammals and sea turtles. The explosive removal of offshore structures may negatively impact protected species. As a Federal agency, MMS is required to ensure that the oil and gas activities it regulates comply with regulations such as the National Environmental Policy Act (NEPA), the Marine Mammal Protection Act (MMPA), the Endangered Species Act (ESA), and the Outer Continental Shelf Lands Act (OCSLA). Presently, the incidental “take” of sea turtles is permitted in conjunction with the explosive removal of offshore structures. Because industry is moving their activities into deeper water, the explosive removal of these structures may negatively impact protected species for which no incidental take is currently permitted.

The MMS requires the best available information regarding the environmental impacts of using explosives underwater, the different explosive technologies used for structure removals, and the probable environmental impacts from these methodologies. As a first step, a comprehensive search and integration of existing technical information is needed. This information search and synthesis is proposed to develop a rational basis for management decisions associated with the explosive removal of offshore structures and the protection of marine mammals and sea turtles.

Objectives This information search and synthesis study seeks to locate, organize, annotate and synthesize historical and new information concerning the technical aspects of using explosives to remove underwater structures.

Methods An extensive search of the published literature and unpublished data sets, reports and manuscripts, will be performed. Recent and ongoing research will be identified. Trends in

methodology should be characterized. Pertinent resources should be annotated and developed as a large digital database.

Products An annotated bibliography, final report, data sets, and visuals. Hard copies of all resources identified in the bibliography should be included.

Importance to MMS The oil and gas industry commonly uses explosives to remove offshore structures in shallower waters of the OCS. The growing trend of placing oil and gas structures in deeper waters (waters seaward of the 300 ft isobath) may negatively impact protected species when these structures are removed using explosives. Therefore, this action requires that MMS conduct a formal consultation per the ESA and MMPA with the NMFS. The MMS requires information concerning the technical methodology of using explosives to remove underwater structures to make management decisions concerning structure removals in conjunction with protected species.

Date Information Required: The information sought in this study is widely distributed and is currently not available in a comprehensive form. This information will be used as soon as available to support pending or future consultations with the NMFS concerning protected species and the explosive removal of offshore structures. Furthermore, the information will be used to develop flexible and suitable mitigation measures to enable industry to utilize explosives for removing offshore structures while also protecting marine mammals and sea turtles.

Revised date: 11/7/2001

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDY PLAN FY 2002-2004

Region: Gulf of Mexico

Planning Area(s): Western and Central Gulf of Mexico

Type: Competitive Procurement

Title: Pressure Wave and Acoustic Properties Generated by the Explosive Removal of Offshore Structures: Potential Effects on Protected Species

Cost Range (in thousands): \$1280 to \$1,920

Period of Performance: FY 2002-2004

Description:

Background Approximately 4000 oil and gas platforms exist on the U.S. Outer Continental Shelf (OCS). Within one year of lease termination, the MMS requires that platforms be removed from the OCS. The most common method for removing platforms is severing them below the water line using explosives. However, the pressure wave and acoustic impacts created by underwater explosions can kill or harm protected marine mammals and sea turtles that may be in proximity to the detonation site.

As a Federal agency, MMS is required to comply with the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA). Mitigation procedures exist to minimize impacts to protected species. The mitigation measures are legally applicable for structure removals performed on the continental shelf (underwater lands that are landward of the 656 ft isobath). However, these mitigation measures are only practical for structures that occur in waters less than 180 ft in depth, and not for deeper waters where industry has placed and is presently removing offshore structures with explosives. Recently, the National Marine Fisheries Service (NMFS) adopted the dual criteria of 12 psi and 180 dB re 1 Pa for “take” harassment zones. These criteria are based on tests of explosives that were detonated in open water. However, MMS requires that offshore structures be severed 15 feet below the mudline. It is conceivable that the structure and surrounding sediments absorb and dampen the pressure wave and acoustic properties of an explosive used to remove an offshore structure. Therefore, MMS needs data to determine the pressure wave and acoustic properties of explosives used to remove offshore structures so that the reputed dampening effects may be accurately measured and demonstrated to the NMFS. These data can then be used to more accurately calculate the “take” harassment zones for marine mammals and sea turtles specific to structure removals.

Objectives The purpose of this study is to 1) quantitatively measure the underwater pressure waves and acoustic properties generated by the detonation of explosives used for offshore structure removals; 2) investigate the reputed dampening effects of the structure and surrounding sediments; and 3) provide MMS with scientifically valid data that accurately reflect the methods used by industry to remove offshore structures with explosives, so that the “take” harassment impact zones of protected species may be more accurately calculated.

Methods The study should use the best available technology and equipment to conduct a scientifically valid experiment that quantitatively measures the underwater pressure waves,

shock waves, and acoustic energy associated with explosive removal of offshore structures. Variables to be investigated include explosive charge weight, explosive charge configuration (i.e., bulk vs. shaped), explosive material, depth of burial of explosive charge (i.e., 15 feet to 3 feet below the mudline), the sediment composition where the structure is located, and shelf vs. slope environments. Measurement of peak pressure and received sound level should be recorded at various depths in the water column and distances from the explosive detonation.

Products Written and digital reports containing a pressure wave and acoustic data set, critique of data sets, analyses of data sets, and recommendations.

Importance to MMS The potential effects of anthropogenic noise on marine mammals and sea turtles is a high profile and environmentally sensitive issue. Currently, there is inadequate data available on the pressure wave and acoustic properties generated by the explosive removal of offshore structures for management decision-making relative to the protection of marine mammals and sea turtles. The NMFS has set forth the dual criteria for harassment of protected species that do not necessarily or adequately account for methods that industry uses to remove OCS structures. Therefore, information concerning the physical properties of explosive detonations, as conducted by industry, would greatly facilitate the development of flexible and suitable mitigations for this activity.

Date Information Required: The scientific studies available concerning the use of explosives underwater do not adequately reflect the methods used by industry to remove offshore structures. Therefore, data is not available to de-link the NMFS criteria based open-water blast studies, from the reputed dampening effects of detonating explosives below the mudline, as performed by industry. This information will be used as soon as it is available to develop reasonable and prudent mitigation measures to protect marine mammals and sea turtles while performing explosive removals of offshore structures.

Revised date: 11/7/2001

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDY PLAN FY 2002-2004

Region: Gulf of Mexico OCS Region

Planning Area(s): Western

Type: Competitive Procurement

Title: Long-term Monitoring at the East and West Flower Garden Banks

Cost Range (in thousands): \$320 to \$480

Period of Performance: FY 2002-2005

Description:

Background This is a continuation of a series of previous monitoring efforts developing a long-term database related to the environmental health of the East and West Flower Garden Banks. This study is important for validating the decision to relax the lease-stipulated requirement on the offshore industry to monitor exploratory or development and production activities within the 1-mile zone of the banks. Oil and gas activity in the area has continually increased in recent years. The East and West Flower Garden Banks have received an increasing variety of protective special area designations including Habitat Area of Particular Concern (HAPC) for Essential Fish Habitat (EFH) by National Marine Fisheries Service (NMFS) and Special Ocean Site (SOS) by the Environmental Protection Agency.

Objectives This effort will continue the long-term monitoring at the East and West Flower Garden Banks to detect any subtle, chronic effects from natural and man-induced activities that could potentially endanger community integrity.

Methods The monitoring will be consistent with past MMS topographic features monitoring, as well as the previously required lease stipulation monitoring for activities located within the 1-mile zone of the Flower Garden Banks. Techniques are similar to most all other coral reefs monitoring studies. Observations shall be made to evaluate coral colonies, accretionary growth, and general community health. Continuously recording water quality instrumentation was added to the ongoing study in 2001. These instruments will be maintained and data analyzed for a variety of water quality parameters.

Products An annual narrative report, videotapes and datasets, peer-reviewed, and scientific publications.

Importance to MMS Ongoing monitoring at the Flower Garden Banks is important to validate and to sustain our contention that the lease stipulations provide effective mitigation of impacts to the offshore environment and particularly, these sensitive and unique biological features.

Date Information Required: Continuation of the proposed study is important to validate the decision to relax the lease-stipulated requirement on the offshore industry to monitor exploratory or development and production activities within the 1-mile zone of these topographic features.

Revised date: 11/7/2001

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDY PLAN FY 2002-2004

Region: Gulf of Mexico OCS Region

Planning Area(s): Gulfwide

Type: Competitive, Simplified Procurement

Title: Incorporating Survey Information from MMS Studies into CORIS

Cost Range (In thousands): \$40 to \$60

Period of Performance: FY 2002

Description:

Background MMS's corporate environmental database, Coastal and Offshore Information System (CORIS), holds a variety of valuable information. In addition to biological and socioeconomic data, CORIS has a geo-bibliography component. Geo-bibliography data includes study footprints and all survey locations such as moorings and transect lines. In April 2001, MMS will receive a GIS tool, which quickly queries and geographically displays this type of data. Currently there is study requirement to submit geo-bibliography data, however this information needs to be captured from existing study reports.

Objectives The objective of this study would be to develop digital geo-bibliography data from 50 MMS-funded study reports.

Methods MMS staff will identify 50 studies from various disciplines. Survey locations and footprints will be digitized and attributes including date, sampling method, and equipment type will be recorded.

Products The final product will be a series of tables (ArcInfo or DBF) and coverages/shapefiles in the format already identified by ITD for its existing data loader. Once the deliverable is received it can be loaded into CORIS within days.

Importance to MMS Over the years we have collected a wealth of studies data, which has been valuable in the analysis done by Leasing and Environment. However because there is so much information it becomes difficult to locate what is most up to date and what is relevant to a particular analysis. As the number of studies increase, it becomes even more important to populate CORIS with geo-bibliography data.

Date Information Required: This study takes MMS studies and puts them in a more usable framework for EIS preparers. This would be especially useful for the preparation of the multi-sale EIS.

Revised date: 11/7/2001

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDY PLAN FY 2002-2004

Region: Gulf of Mexico OCS Region

Planning Area(s): Gulfwide

Type: Competitive Procurement

Title: *Deepwater Program:* Understanding the Processes that Maintain the Oxygen Levels in the Deep Gulf of Mexico

Cost Range (in thousands): \$160 to \$240

Period of Performance: 2002-2003

Description:

Background With increasing activities in deepwater Gulf of Mexico, a greater understanding of the environment below 1000 m. is necessary. Data from the early 1960s indicates that the deep Gulf is homogenous with constant temperature, salinity, and relatively constant oxygen, although the oxygen data from this era is regarded as questionable. Data collected during a 2000 cruise for the Northern Gulf of Mexico Continental Slope Habitats and Benthic Ecology study confirms that the deepwater Gulf of Mexico has a relatively constant oxygen concentration of 5 ml/L. Since the effective sill depth of the source water is 1600-1800 m. and the deepest part of the Gulf is >3500 m., the replenishment of oxygen to the deepwater is still not well understood. Also, there is a layer of low oxygen from 400-1000m meters that essentially is a cap for the deepwater. Simultaneously, the residence time of the deepwater, which is necessary to calculate the replenishment of the oxygen, is also not well understood. Recovery time for a stressed environment is longer in ultra deepwater than shelf environments. The flushing time of the deep Gulf is an important element for understanding the impacted environment. In addition, recent modeling studies of the deepwater indicate that the Eastern Gulf of Mexico basin does not exchange water with the Western Gulf of Mexico at a rate to explain the high concentration of oxygen in the Western Gulf.

As a first step, a literature review and evaluation of oxygen data for the deep Gulf of Mexico is necessary. Processes that maintain the oxygen level also need to be identified and modeled. The model could then be used to evaluate the inputs from oil and gas activities to determine the effects of cumulative impacts. From this information, data gaps can then be identified and a program to fill those data gaps can be developed. Possible methods for determining the flushing time of the Gulf includes the use of tracers such as SF₆ could be used to make these measurements. The precise location for doing an experiment would need to be determined.

Objectives The objective of this study is to understand the rates of processes occurring in the deep Gulf of Mexico. In particular, the focus should be on the high levels of oxygen in the deep water and the balance that maintains this level. An understanding is important to enhance knowledge of fundamental processes and to describe the affected environment. The study would include: 1) literature review and evaluation of the available oxygen data, 2) development of a simple, conceptual model describing the sources and sinks of oxygen in the deep Gulf, 3) identify information needs for the conceptual model, and 4) design methods for filling the data gaps.

Methods The method would be include a literature review, development of a conceptual model, and designing any appropriate data gathering methods.

Importance to MMS The flushing time of the deep Gulf of Mexico is an important factor for understanding and describing the affected environment in NEPA documents.

Date Information Required: The information is needed to describe the affected environment in EAs and EISs that cover ultra deepwater activities.

Revised date: 11/7/2001

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDY PLAN FY 2002-2004

Region: Gulf of Mexico OCS Region

Planning Area(s): Central

Type: Cooperative Agreement

Title: History of Offshore Oil Development in the Gulf of Mexico, Phase II:
Research and Synthesis

Period of Performance: FY 2002-2005

Description:

Background The development of Louisiana's offshore petroleum industry is a remarkable story of inventiveness, entrepreneurship, hard work, and risk-taking that turned the State's relatively isolated and impoverished coastal communities into significant contributors to the U.S. and world economies. The study will address this history including the development of the related service, support, and fabrication industries that give the offshore industry its unique economic and social profile. The study will examine the role of, challenges to, and changing nature of technology (exploration, development, production, transportation, fabrication) economics, labor organization and demand, business organization and practices, and other factors as the offshore industry evolved into deeper and deeper waters. The study will look at the role played by local communities and the environment in shaping these developments and, in turn the role the industry has played in shaping the communities. Finally, the study will examine the development of the state and federal regulatory regime as a response to this massive industry. The offshore industry and its associated support industries are little known, understood, or documented, and their dynamic role in the U.S. economy is virtually invisible. Moreover, many of those who have pioneered in its development are aged. This knowledge will be forever lost as industry pioneers die. The GOMR is considering providing substantial support for a multi-year project to study the development of Louisiana's offshore petroleum industry.

Objectives A major research effort will be to collect and archive the "oral histories" of the actors in this story to compensate for the lack of existing documentation. The first years of Phase II will emphasize the gathering and archiving of oral histories at the community and company level and the synthesis of existing material on the industry and its local effects. The first years will produce a series of analytical reports on strategic topics (e.g., the role of local innovation in the growth of the oil industry, changes in industry organization and business practices related to offshore activity). The final years will focus the field efforts on questions found critical to completing the project, continue producing the series of analytical reports, and develop a book on the first 100 years of the Louisiana petroleum industry that emphasizes the development of the OCS.

Methods This project is methodologically innovative. It will join oral history research conducted within communities with more analytical socioeconomic research conducted at universities. The one-year Phase I Pilot Study will refine the methodology and management

structure needed to coordinate community-centered and community-driven research with analytical goals. Phase I will also produce deliverables including (at minimum) an ITM session, annotated bibliography, oral history transcripts, and a final report.

The design, scale, and scope of Phase II are dependent on the outcome of Phase I and on other agency funding considerations. It may not be funded, it may be funded for one or several years, or it may be divided into several more phases.

Products ITM sessions, annotated bibliography, archived oral history transcripts, a set of final reports documenting various economic and social aspects of the offshore petroleum industry, a final synthesis report, a trade book the history of Louisiana's offshore industry.

Importance to MMS While any research that gives this industry a "human face" would be a contribution to the OCS program, Louisiana, and the country, the agency has more programmatic objectives. (1) MMS is charged by NEPA with documenting the social and economic effects of the industry. The NRC noted that the GOMR's fifty-year history of offshore oil provides a natural laboratory for studying its effects. To "calibrate" this laboratory, the changing dynamics of the industry (such as its technological evolution, changes in business practices, changes in financing) must be documented and analyzed. (2) MMS is charged by NEPA with assessing the cumulative effects of the industry. This fifty-year history is the commutative effects as well as the current "baseline". (3) Associated with the baseline issue, MMS has been requested by the Science Committee and others to synthesize its socioeconomic research findings. This study will involve a wide range of experts in synthesizing this material. (4) The study will help distinguish the effects of onshore oil from offshore oil, and offshore oil from the OCS. (5) The social and economic effects of the offshore industry are often defined abstractly, in terms of literature on other industries in other regions. This study is designed to serve as a "scoping" vehicle. Effected parties will define the salient social and economic issues in a non-adversarial milieu. The study has been organized to provide the agency with effective outreach to other federal and state institutions as well as communities. (6) The study can be considered as "mitigation". Knowledge about the industry and its origins are of value to the people of the State of Louisiana.

Date Information Required: This study will produce annually final reports on various aspects of the industry and its social and economic consequences. This information will be used as it comes available in focusing MMS environmental assessments and research.

Revised date: 11/7/2001

2.3 Profiles of Regional Studies Proposed for FY 2003 and Beyond

Gulf of Mexico Region Proposed Studies for FY 2003 and Beyond

Studies Plan Page #	**	Title
25	PO	Northern Gulf of Mexico Shelf and Slope Model Hindcast
27	PO	<i>Deepwater Program:</i> Central Gulf of Mexico Midslope Physical Oceanography Study
29	PO	<i>Deepwater Program:</i> Physical Oceanography of the Slope and Rise (POSAR)
31	FE	Spill Occurrence Estimators for OCS Operations
33	FE	Long-term Effects of Oil and Gas Activities on the Mississippi and Alabama Shelf
35	FE	Environmental Risks Associated with Support Vessel Usage by the OCS Oil and Gas Industry
37	SE	Case Studies of Key Gulf Coast Communities
39	SE	<i>Deepwater Program:</i> A Collaborative Investigation of Offshore Oil and Gas Industry Cost Structure Characteristics (G3200/Gambino)
41	SE	<i>Deepwater Program:</i> World War II Shipwrecks
43	OT	<i>Deepwater Program:</i> Increasing the Understanding of Gas Hydrates for Model Calibration
45	OT	Gulf of Mexico Ozone Modeling Analysis
47	OT	Satellite Remote Sensing Data Retrieval in the Gulf of Mexico Region
49	OT	<i>Deepwater Program:</i> Methane Hydrates in Ultra Deepwater
51	OT	<i>Deepwater Program:</i> Verifying Methane Hydrate on the OCS
**	PO = Physical Oceanography FE = Fate & Effect BIO = Biology PS = Protected Species SE = Social & Economic OT = Other	

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDY PLAN FY 2002-2004

Region: Gulf of Mexico OCS Region

Planning Area(s): Central and Eastern

Type: Competitive Procurement

Title: Northern Gulf of Mexico Shelf and Slope Model Hindcast

Period of Performance: FY 2003-2006

Description:

Background The DeSoto Canyon study was supported by MMS to provide information and analysis which expands the understanding of physical oceanographic conditions and processes in the northeastern Gulf of Mexico. Considerable data were collected along the shelf and slope of western Florida panhandle, Alabama, and Mississippi. This data includes hydrographic data, ADCP, current meter data, temperature and salinity time series data, and satellite altimetry; ancillary data such as SCULP drifter data, meteorological data, water level data, and river runoff data are available. Interpretation of these data in the DeSoto Canyon final report includes a section on slope circulation patterns.

Physical oceanographic numerical models grounded in reality through model/data comparisons or data assimilation can advance understanding of physical oceanographic conditions and processes and the benefit of these data to MMS can be maximized.

Objectives To advance our understanding of the physical conditions on the northern Gulf of Mexico midslope region using numerical modeling techniques in conjunction with physical oceanographic data previously collected by MMS.

Methods The model must be a numerical ocean circulation model based on assumed physics, and model input forcing shall include at a minimum surface wind driving derived from available wind data, river runoff, surface heat flux, and assimilation of deep mooring data. The model domain should include (but is not limited to) the continental shelf and slope from the coast to the 2000-meter isobath and from 85.5W to 89.0W. An accurate hindcast of ocean circulation within this computational domain during the 1997-1999 field measurement period of the DeSoto Canyon study will be performed. Model/data comparison will include (but are not limited to) summary statistics, correlations, coherence, and phase between model output and independent deepwater observational data.

Products Model output and a final report of findings will be provided to MMS.

Importance to MMS The MMS is responsible for assuring that the exploration and production of oil and gas reserves located more than three miles offshore and within the U.S. Exclusive Economic Zone, are conducted in a manner that reduces risks to the marine environment.

An accurate hindcast of shelf and slope circulation and transport in the northern Gulf of Mexico between 85.5W and 89.0W can contribute to the MMS mission to evaluate effects that currents can have on the operating integrity of offshore production structures and in assessing equipment and structure design. This hindcast will give us further information about physical oceanographic conditions adjacent to the high-speed current events observed in 1999 in deep water over the 2000-meter isobath at about 90.0W.

Date Information Required: This study will add to our understanding of circulation in the Eastern Gulf of Mexico and will be useful in the preparation of Eastern Gulf Sale EISs.

Revised date: 11/7/2001

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDY PLAN FY 2002-2004

Region: Gulf of Mexico OCS Region

Planning Area(s): Central

Type: Competitive Procurement

Title: *Deepwater Program:* Central Gulf of Mexico Midslope Physical Oceanography Study

Period of Performance: FY 2003-2005

Description:

Background The GulfCet Program was supported by MMS to determine the distribution and abundance of cetaceans along the continental slope in the northern Gulf of Mexico and to help the MMS assess the potential effects of deepwater oil and gas exploration and production on marine mammals in the Gulf of Mexico. Results of GulfCet have shown sperm whales to be generally found in mid to lower slope regions in water over 1000 m in depth. There was some indication that in general sperm whales may be found in conjunction with the edge of warm-core rings, where upwelling events may enhance productivity and prey abundance.

An area of exceptionally frequent and consistent sperm whale sightings from 1991-1999 is located near the 1000-meter isobath off of southeastern Louisiana between approximately 28.24N 89.18W, and 28.57N 88.84W. Currents in this region have never been measured or studied in the past, and it is not known if seasonal upwelling occurs here. By examining physical oceanographic parameters throughout the water column, we can determine if midwater currents transport water into this area from the west northwest direction of the Mississippi Canyon region, or if the flow into and through the region is primarily along the 1000-m isobath, as has previously been suggested, along a southwest to northeast axis. By focusing on this small area it may be possible to detect the presence and strength of small, deep, highly ageostrophic eddies that are thought to play a part in high speed current events elsewhere on the central Gulf of Mexico slope, as well as to determine the local circulation and whether this small region is susceptible to seasonal upwelling.

Objectives To advance our understanding of the physical conditions in a small Central Gulf of Mexico midslope region which attracts sperm whales and at which they have consistently been sighted, and to determine the temperature and salinity time series fields and simultaneous speed and direction of flow into and out of this region. To determine if local upwelling occurs which could bring nutrient-rich waters into this region, and to determine if eddies as small as 30-70 km may be affecting circulation along the 1000-meter isobath.

Methods This study is expected to use three moorings with current meters, temperature and salinity sensors at 10m, 500m, 800m, and 990m to monitor and measure physical parameters in the area of high sperm whale concentration along and near the 1000-meter isobath between 28.24N 89.18W and 28.57N 88.84W, and two similar moorings along and near the adjacent 1500-meter isobath but with current meters, temperature and salinity sensors only at 1490m,

1000m, and 800m, in order to determine if upwelling occurs. The data from these moorings will be analyzed using standard time series analysis techniques to successfully meet the objective of the study.

Products Data and a final report of findings will be provided to MMS.

Importance to MMS The MMS is responsible for assuring that the exploration and production of oil and gas reserves located more than three miles offshore and within the U.S. Exclusive Economic Zone, are conducted in a manner that reduces risks to the marine environment. Sperm whales are an endangered species. Understanding the conditions in which this endangered species thrives will allow the MMS to better understand the effects of oil and gas operations on sperm whales, and to meet our responsibilities under the Marine Mammal Protection Act of 1972 (MMPA) and the Endangered Species Act of 1973 (ESA).

Local circulation and transport can contribute to the MMS mission to evaluate effects that currents can have on the operating integrity of offshore production structures and in assessing equipment and structure design, and could possibly contribute to MMS evaluation of local trajectories of oil and other contaminants within this midslope region.

Date Information Required: This study will complement MMS data collection in the upcoming MMS Exploratory POSAR study as well. These data will provide information on smaller scales and in a different region of the Central Gulf of Mexico than will Exploratory POSAR.

Revised date: 11/7/2001

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDY PLAN FY 2002-2004

Region: Gulf of Mexico OCS Region

Planning Area(s): Gulfwide

Type: Competitive Procurement

Title: *Deepwater Program: Physical Oceanography of the Slope and Rise (POSAR)*

Period of Performance: FY 2004-2009

Description:

Background Initial observations of deepwater currents in the Gulf by a Minerals Management Service study in the mid 1980's revealed weak to moderate currents driven by Topographic Rossby Waves (TRW). These currents were essentially barotropic below ~1,000 m and varied at time scales of 15 days. However, observational and modeling studies similar to the recently completed LATEX or the ongoing Northeastern Gulf of Mexico Physical Oceanography Program have not been conducted in the deep Gulf. Recent data (Minerals Management Service and proprietary records) have shown that strong currents, 1-2 knots (50-100 cm/s), occur in the deepwater of the Gulf of Mexico. The processes responsible for causing such strong flows are not known. Also, the Loop Current and its eddies are very active in the deep Gulf.

Known processes that need to be studied included the interaction of Loop Current eddies with the bottom topography. Generation and evolution of eddy-like features, topographic steering of flows, mid-water jets, inertial currents, and wind-driven flows. Also, more information is needed concerning the currents near the Mississippi Canyon where newly separated eddies begin their westward voyage across the deep Gulf. The bottom relief on the slope and rise is extremely rough and can drive different physical processes that are little understood or studied.

Objectives The objectives of this study are: (1) to deploy arrays of moorings to collect oceanographic observation across the entire water column; and (2) to analyze and interpret these measurements using existing theories relevant to the oceanographic processes identified. Among potential processes to be examined are: interaction of LC eddies with the topography; generation and evolution of cyclonic features; topographic steering of flows; and wind driven circulation.

Methods This effort will deploy moorings and conduct oceanographic cruises at suitable time intervals to resolve relevant temporal and spatial scales. Remote sensing data will also be employed to examine the synoptic thermal and sea surface topography of the area. Detailed surveys of important features will be conducted to investigate their characteristics. Because of its complexity and relevance, a planning workshop was conducted on September 2000 in New Orleans. This workshop helped focus the study objectives and design.

Products A final report and CDs containing raw data.

Importance to MMS The results from this study will provide information regarding the interactions of LC eddies with the topography; generation and evolution of eddy-like features; topographic steering of flows; wind driven circulation; and mid-water column jets. The study will support other ongoing studies by identifying the relevant physical processes and increase the understanding of them and their interactions, and by providing data for numerical model verification. These results should provide MMS with values of the seasonal and annual variabilities of the physical processes studied. The results will also be available for completing risk assessments used by MMS for preparation of NEPA documents. These results will also help understand sediment transport and recently discovered erosional mega-furrows (Bryan et al., 2000) and as ancillary information for analysis of biological data.

Date Information Required: The participants of the physical oceanography session of the MMS “Workshop on Environmental Issues Surrounding Deepwater Oil and Gas Development” (Carney, April 1997) recognized this project’s priority and recommended it begin after completing the “Deepwater Physical Oceanography Reanalysis and Synthesis of Historical Data” and “Study of Physical Processes Over the Slope and Rise Using Numerical Models” studies. However, the participants of the September 2000 Workshop recommended starting this study after completion of an exploratory study which is in planning.

Revised date: 11/7/2001

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN FY 2002-2004

Region: Gulf of Mexico OCS Region

Planning Area(s): Western, Central, and Eastern

Type: Competitive Procurement

Title: Spill Occurrence Estimators for OCS Operations

Period of Performance: FY 2003-2004

Description: The study will analyze methods to predict oil spill frequency from OCS operations and propose the most appropriate estimators of spill risk to serve the MMS in their environmental analysis of industry activities.

Background Currently, spill occurrence rates are available for spills of 1,000 bbl or greater from two sources, platform and pipelines, and are based on the assumption that OCS spills can be predicted based on the volume of oil produced or transported through a pipeline. The data used to calculate these rates are based on annual historical OCS spill records and production volumes. We believe the predictors of spill frequency may have become more complicated as industry develops different technological tools and moves farther offshore into deeper waters. For example, does the spill rate adequately predict the spill risk from the following: large semisubmersible drilling vessels, drilling for dry gas, subsea well complexes, central processing units processing large volumes of oil from many leases and high rate production wells.

Using volume of oil to determine spills from pipelines has always been problematic. Pipelines carry oil from a large number of production sites, making it difficult to estimate the contribution from a lease sale. Does the pipe diameter or length of pipe contribute to an increased risk? There are also problems with using a spill rate based on oil production at both the post-lease stage, where specific risk might be related to sources or causes, such as blowout risk, oil volume stored, and the pre-lease stage, where generalities concerning spill occurrence risk from a large number of facilities and over the life of a lease sale are needed.

Objectives The objectives of this study are to:

1. review the present procedures and historical data used.
2. provide statistical support to the MMS to determine the best exposure variables as predictors of spill frequency.
3. calculate risk constants based on identified exposure variables that will allow the MMS to best calculate probable accident frequency where these exposure variables are known.
4. develop risk factors based on spill sizes, water depth and technology differences.

5. propose alternative oil-spill frequency indicators suitable for predictive use by MMS when reviewing industry plans of exploration, plans of production, pipeline applications, and lease sales.

Methods

1. The contractor will compile and analyze records of spill occurrences related to OCS operations.
2. The contractor will analyze OCS operations relative to spill risk.
3. The contractor will evaluate exposure variables suitable for predictive purposes, providing an evaluation of the confidence limits of the data, and quantifying the precision of the estimates of spill probabilities.

Products A final report.

Importance to MMS The Oil Spill Risk Analysis (OSRA) is a cornerstone of the MMS's NEPA documents. There are continuing concerns over the ability of the analysis to adequately predict spill occurrence risk, given the existing approach.

Date Information Required: OSRA is used in the preparation of EIS's and an updated and revised method would be used as soon as it is available.

Revised date: 11/7/2001

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDY PLAN FY 2002-2004

Region: Gulf of Mexico OCS Region

Planning Area(s): Gulfwide

Type: Competitive Procurement

Title: Long-term Effects of Oil and Gas Activities on the Mississippi and Alabama Shelf

Period of Performance: FY 2003-2005

Description:

Background The opportunity to study the long-term effects of oil and gas development on the Mississippi-Alabama-Florida shelf is now possible. Baseline measurements were made during extensive studies in the mid-1970s. It is now possible to evaluate the effects of oil and gas activities on this dynamic shelf and compare the results with those collected almost 30 years ago. An initial study was conducted by the State University System Institute of Oceanography from 1974-1975 and completed by Dames and Moore in 1976-1977. The general findings were that the shelf area was relatively pristine with some influence from the Mississippi discharge. Part of the study area was revisited in the late 1980s as part of the MAMES project. Oil and gas activities have increased along the shelf since the initial study and it is time to revisit the area and evaluate whether these activities have resulted in cumulative contamination of the continental shelf.

In contrast, the Florida shelf, which was also sampled during the MAFLA study, has not been affected by oil and gas activities. This is an opportunity to compare a region that has had ever increasing oil and gas activities with a region that has not. Of course, other activities may have altered the pristine Florida shelf, but these could not be attributed to oil and gas activities, which have been restricted for the past 30 years.

Objectives The objectives of this study are to: 1) collect and analyze water, sediment, and biological samples from the Mississippi-Alabama-Florida shelf using the same parameters as previous studies and 2) compare the results with the studies from the 1970s and 1980s to see if there has been any degradation to the marine environment as a result of oil and gas activities.

Methods A single sampling cruise of designated sites located in the same place as those from the previous MAFLA study. The same parameters would be analyzed, including trace metals, petroleum hydrocarbons, benthic and fish composition, and general hydrodynamic information. The results would be compared to the previous study and an evaluation of the effects (or lack of effects) would be made.

Products A final report.

Importance to MMS The MMS is constantly faced with defending oil and gas activities as environmentally sound. This study would provide data where activities have been occurring for

decades and where previous studies were performed. The information could be used to support future development in as yet undeveloped areas where it can be reasonably demonstrated that no long-term effects from oil and gas activities occur.

Date Information Required: The information is needed within the next few years to support future development in as yet undeveloped areas.

Revised date: 11/7/2001

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDY PLAN FY 2002-2004

Region: Gulf of Mexico OCS Region

Planning Area(s): Western, Central, and Eastern

Type: Competitive Procurement

Title: Environmental Risks Associated with Support Vessel Usage by the OCS Oil and Gas Industry

Period of Performance: FY 2003-2004

Description: This study will complete a risk assessment of OCS service vessel usage.

Background Approximately 24 types of service vessels cater to the OCS oil industry. These vessels produce noise above and under water, discharge routine wastes and bilge waters, air emissions, make waves that erode channel banks, and disturb the seafloor with anchors. In particular, they have been responsible for an increasing number of collisions and are viewed by the public as a potentially significant cause of oil spills. Deepwater OCS activities have resulted in an increased demand for service vessels and particularly those qualifying for deepwater operations. As industry moves into deeper waters, larger vessels with deeper drafts have been phased into service. Deeper access channels are needed for these vessels to reach shorebases. The types and amounts of discharges and potential spills from these larger vessels should be analyzed. Navigation channel usage is currently being summarized by the Army Corps of Engineers for the MMS and can serve for analysis of channel usage. Of particular concern, information on accident occurrences that have resulted in environmental or economic damage and oil spills is unavailable.

Objectives The objectives of this study are to:

1. Assist the MMS in evaluating ongoing and future environmental impacts from OCS service vessel usage
2. Provide statistical support to the MMS by determining the rate, size, locations, and causes of associated accidents (oil spills and collisions) occurring due to OCS service vessel usage and compared to local and regional vessel traffic patterns
3. Determine the effect deepwater operations will have on service vessel usage and associated impacting factors

Methods The contractor will:

1. analyze historical data on service vessel usage, impact events, and routine effects to the environment.

2. will conduct a fault tree analysis to determine the variables of concern relevant to service vessel usage.

Products The study will document the frequency and types of activities of OCS service vessels and the major impacting factors associated with service vessel usage. It will determine navigation usage patterns for existing and future OCS service vessels. It will project the level of expected impact or risk from these factors and how these factors vary with water depth and type of facility servicing, and will develop estimates of collision and spill rates.

Importance to MMS The MMS needs information about service vessels to incorporate in EIS analyses.

Date Information Required: This information is used for the preparation of EIS's and will be used as soon as it is available.

Revised date: 11/7/2001

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDY PLAN FY 2002-2004

Region: Gulf of Mexico OCS Region

Planning Area(s): Gulfwide

Type: Competitive Procurement

Title: Case Studies of Key Gulf Coastal Communities

Period of Performance: FY 2003-2005

Description:

Background The oil industry has played an important role in the affairs of the Gulf Coastal States for almost a century, and offshore oil has been produced for half of that. However, the MMS Scientific Advisory Committee, several official reviews of the MMS Environmental Studies Program (e.g. National Research Council), State governors' offices, and others have noted a general lack of information concerning the effects of this industry on the economies and social systems of Texas, Louisiana, Mississippi, and Alabama. The National Research Council (1992) noted that, because of this long history, these States provide a "perfect laboratory" for understanding those effects, and that by exploring this laboratory MMS will be better able to assess, monitor, and mitigate the effects of its program. The State of Louisiana identified this same problem by filing a lawsuit seeking to halt an OCS lease sale in the Western Gulf of Mexico (GOM) citing, as one reason, the lack of sufficient knowledge of historic social and economic impacts of the OCS program on the State.

For the past few years, MMS has been addressing this shortcoming by developing a socioeconomic baseline. By baseline, MMS means an analysis of the consequences, over time, of OCS developments rather than a "snapshot" description of an area at one point in time. This is a complex research task and MMS has launched a series of studies that build upon each other. The first, Socioeconomic Baseline for the GOM (Phase 1) developed a database to support future research. The Historical, Social and Economic Impacts on the GOM (Phase 2) and several smaller studies supported through the Coastal Marine Institute at Louisiana State University have begun to exploit this database looking at OCS issues region wide. This study "Case Studies of Key Gulf Coastal Communities" will examine effects of the program at the community level.

Very little information exists on long-term, community-level effects of the OCS oil and gas program. Information will be developed in the socioeconomic baselines and other MMS-supported socioeconomic research.

Objectives This effort will examine key communities identified in previous GOM baseline work, focusing on topics identified as important. Goals of this study are to: 1) refine our understanding of impacts and their effects on communities and groups within those communities; 2) identify the historical sequence of effects, with special attention paid to differentiating historical impacts related to State-controlled oil and gas development versus OCS development in the key communities; and 3) refine our understanding of the mechanisms that cause these effects.

Methods This study will employ a combination of standard social and economic methods, such as ethnographic observation, formal questionnaires, and the analysis of existing, publicly available data and literature. The study will stress careful, detailed descriptions and the marshaling of varied data to support its conclusions. This study will also be comparative, selecting communities that have played different roles in the offshore industry, communities that have adjusted well or with difficulty, and (possibly) control communities that have not experienced effects.

Products A final report.

Importance to MMS This baseline information will be used to support the design of a monitoring program and mitigative approaches to identified social and economic issues.

Date Information Required: This information will be used for management decisions related to ongoing production and development activities, as well as proposed exploratory operations. As such, the information will be useful as it is collected and reported.

Revised date: 11/7/2001

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDY PLAN FY 2002-2004

Region: Gulf of Mexico OCS Region

Planning Area(s): Deepwater Gulfwide

Type: Cooperative Agreement

Title: *Deepwater Program: A Collaborative Investigation of Offshore Oil and Gas Industry Cost Structure Characteristics (G3200)*

Cost Range (in thousands): \$284 to \$426

Period of Performance: 2002-2005

Description:

Background Over the last two years, the Minerals Management Service (MMS) has developed, via the Coastal Marine Institute study *Cost Profiles and Cost Functions of Gulf of Mexico Oil and Gas Development Phases for Input-Output Modeling*, quantitative models to estimate the economic impacts of offshore activities on Gulf of Mexico coastal communities for EIS analysis. While this study has produced significant improvements in MMS' economic impact research methods, there is still a considerable amount of work that needs to be completed in order to take these early initiatives to more meaningful levels of achievement. During the course of the cost profile study, it was discovered that there is a limited amount of publicly available information on offshore cost structures on a per activity and per water depth basis. Even more limited is the information on the allocation of these costs across Gulf of Mexico subareas. Near the conclusion of this study, it was recognized that developing more comprehensive information, especially that associated with deepwater activities would need to be facilitated.

Objectives The objectives of this research are to provide the MMS with primary source information associated with the cost characteristics of offshore activities and to expand upon the following shortcomings that materialized in the MMS sponsored cost profiles study:

1. Customizing onshore allocations of costs,
2. Developing cost functions for specific technologies,
3. Creating dynamic expenditure profiles,
4. Developing labor and value added implications, and
5. Understanding contractor contributions and allocations, in offshore activities.

To acquire this information, an Offshore Researchers Collaborative Process (or Collaborative) will be employed. This Collaborative will bring together in a meeting format industry, government, academic researchers, and analysts. Separate groups will be designated, and directed by the project principle investigators, to address each major offshore activity category with data collection, analysis, and commentary.

Importance to MMS The MMS is required by NEPA to document onshore effects of the OCS program. While the MMS has recently made great strides in economic impact modeling, a lack of publicly available oil and gas industry information has hindered these modeling efforts. Unfortunately, there is a disconnect between the oil and gas industry and the government; each does not know what information or data the other possesses, or for that matter, what type of information each other needs. This Collaborative method will bring together all of the integral parties to discuss information needs and data collection. This process will lead to a better relationship with industry and a more holistic approach to meeting MMS' needs. Lastly, by opening these lines of communication, the MMS will also improve its science and economic impact modeling efforts.

Date Information Required: This information will be used in EISs and decision making documents as soon as it becomes available. In addition, the information from this study will be integrated into MMS' economic impact modeling efforts.

Submitted by: Center for Energy Studies, Louisiana State University

Revised date: 11/7/2001

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDY PLAN FY 2002-2004

Region: Gulf of Mexico OCS Region

Planning Area(s): Gulfwide

Type: Competitive Procurement

Title: *Deepwater Program: World War II Shipwrecks*

Period of Performance: FY 2003-2004

Description:

Background Some 40 merchant vessels were sunk on the OCS by German submarines (U-boats) during the Second World War, with most of the casualties occurring in 1942 and 1943. One of the U-boats that patrolled the Gulf, the U-166, was itself lost and presumably lies somewhere on the OCS off the coast of Louisiana. Because these vessels have been on the seafloor for over 50 years, and because of the significant role played by them and their crews in an important period of American and world history, they are likely eligible for the National Register of Historic Places. In addition, an Executive Order signed January 19, 2001, States that “the United States will use its authority to protect and preserve sunken State craft of the United States and other nations, whether they are located in the waters of the United States, a foreign nation, or in international waters.” Since many of these vessels carried U.S. Navy gun crews and were chartered by the United States government to transport oil and fuel for the war effort, many are likely to be considered “State craft.” Over 100 lease blocks, many in deepwater, have been set aside as “shipwreck high probability areas” requiring more intensive surveys by the oil and gas industry to locate these vessels since most of their locations were not precisely reported at the time of their loss. Over the past ten years, however, over a dozen possible World War II freighters and tankers have been identified in remote sensing records obtained during lease block and pipeline surveys.

Objectives The objective of this study is to ground-truth, positively identify, and assess the National Register status of these wrecks in order to properly manage this resource according to MMS’ responsibility for archaeological properties under Section 106 of the National Historic Preservation Act. A second objective involves assessing the known wrecks in deepwater for their properties as a biological habitat. Since these wrecks have lain on the seafloor for nearly 60 years, they can serve as a laboratory to assess the viability of deepwater artificial reefs.

Methods The primary methods of data collection will be by ROV inspection and historical records research. Some diving may be required on wrecks in less than 130 feet of water to better obtain information that would aid in identifying the vessel. Records research will focus on obtaining information that will aid in assessing the National Register eligibility of each wreck and in assessing its status as a protected State craft.

Products A final report.

Importance to MMS Under Section 106 of the National Historic Preservation Act, Federal agencies must apply the National Register Criteria to properties that may be affected by an undertaking. Although none of these properties are threatened directly by an MMS undertaking, the agency does require a more intensive survey regime over some 100 lease blocks specifically to identify these vessels to avoid impacting them. By ground-truthing and positively identifying these wrecks, that survey requirement can, in many cases, be relaxed, resulting in a significant cost savings to operators, especially in deepwater. In addition, Federal agencies have under Section 110 of NHPA the responsibility to inventory and assess resources under its control. While it may be argued that under the OCS Lands Act historic resources on the seabed are not under MMS control, the evaluation of properties discovered as a result of OCS activities demonstrates a good faith adherence to the spirit of this provision. Secondly, an analysis of the wrecks in deepwater for their potential as biological habitats would provide information regarding the viability of artificial reefs at depths below the phototropic zone and aid decisionmakers in issues concerning platform abandonment in deepwater.

Date Information Required: The need for information relating to the potential biological benefits of not requiring seabed restoration of deepwater abandonment is immediate. The assessment of shipwrecks for NRHP eligibility could result in immediate relief for the oil and gas industry and encourage development in deepwater blocks.

Revised date: 11/7/2001

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDY PLAN FY 2002-2004

Region: Gulf of Mexico OCS Region

Planning Area(s): Gulfwide

Type: Competitive Procurement

Title: *Deepwater Program:* Increasing the Understanding of Gas Hydrates for Model Calibration

Period of Performance: FY 2003-2005

Description:

Background Gas hydrates are cage-like structures of water with methane or other small gas or hydrocarbon molecules entrapped that form under low temperature and high pressure conditions. The thermodynamic conditions of pressure and temperature suggest that hydrate should readily form at water depths greater than 300- 400 m. However, observations of gas escaping from sediments do not show the formation of hydrates, unless captured in an inverted sampling tube. Model predictions from incidents of gas release during oil and gas exploration and development activities suggest that hydrates should form, though results from a recent experimental release of gas in deepwater did not indicate the presence of hydrates.

One potential reason for the discrepancy between experimental observations and model results is the requirement that nucleation be initiated by some mechanism before the hydrates form. Several laboratory studies have indicated that nucleation is key to hydrate formation, even under the ideal temperature and pressure conditions. A recent presentation at the Geological Society of America indicated that nucleation was important for the formation of hydrates in marine sediments.

Although observations are reported that suggest nucleation is an important process, little information has been gathered to demonstrate that it is key to the formation and presence of hydrates in the deep ocean. In addition, methods for modeling nucleation processes do not exist.

This study will include laboratory experiments that directly address the nucleation process and conditions that control the process. In addition, the possibility of mathematically describing the process will be explored.

Objectives The objectives of this study are to: 1) increase the understanding of the nucleation process in hydrate formation and 2) develop mathematical techniques to describe the process so that it can be included in models.

Methods Laboratory experiments will be designed to specifically address hydrate nucleation processes.

Products A final report.

Importance to MMS The understanding of nucleation processes in the formation of hydrates is key to model development of hydrate formation in the deep ocean. The MMS will need this information to aid in assessment of hydrate location through a better understanding of the conditions under which the hydrates form.

Date Information Required: The information is needed to assist in the development of hydrate formation models that are presently included in the understanding of incidents involving the release of gas in deepwater.

Revised date: 11/7/2001

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDY PLAN FY 2002-2004

Region: Gulf of Mexico OCS Region

Planning Area(s): Gulfwide

Type: Competitive Procurement

Title: Gulf of Mexico Ozone Modeling Analysis

Period of Performance: FY 2003-2005

Description:

Background This study updates the primary goal of the Gulf of Mexico Air Quality Study (GMAQS) (completed in August 1995) to estimate the impacts of emissions from Outer Continental Shelf (OCS) activities upon ozone. Because of changes in the National Ambient Air Quality Standard for ozone (from a 1-hour standard to an 8-hour average standard), references to the 1-hour standard in the GMAQS are no longer relevant to current air quality requirements. This study will apply the new model selection criteria and modeling protocols and thereby allow relevant comparisons to the new 8-hour ozone standard.

The Gulf of Mexico Air Quality Study was completed in 1995 based on the 1-hour O₃ standard. The Boundary Layer Study of the Central and Western Gulf of Mexico is currently gathering field data. The Breton Aerometric Monitoring Program is expected to begin gathering field data will complete data collection in September 2001. The Gulfwide emissions inventory was completed in 2000.

Objectives The objective of this study is to quantify the NO₂, VOC, and O₃ concentrations in the Gulf coastal areas attributable to OCS production and development sources regulated by the MMS during the selected episode(s). The modeled ozone concentrations will be calculated to allow direct comparison to the 8-hour average National Ambient Air Quality Standard. Additionally, the modeling should determine if the ozone formation in the different areas is NO_x or VOC limited.

Products A final report.

Methods The study requires using the existing onshore and offshore emissions inventories, and onshore and offshore meteorological data to sufficiently depict the pollutant transport processes in the GOMR. Primarily, the existing emission inventories and meteorological data will be used for this study. Photochemical modeling is performed to determine the OCS activity related onshore O₃ and NO₂ impacts. Finally, if O₃ impacting onshore areas is determined to be NO_x limiting or VOC limiting, this information will be used so that decisions can be made as to how best to target emission control strategies. Emissions inventory and pollutant transport information under several current and proposed MMS studies, as well as, other relevant studies will be applied, and where appropriate, incorporated into this modeling effort.

Importance to MMS The information obtained will support cumulative impact analyses for NEPA documents prepared to support GOMR OCS programs. Finally, this study develops a framework for making decisions about where and which emissions should be targeted for controls to reduce current or foreseeable significant impacts.

Date Information Required: The 8-hour ozone National Ambient Air Quality Standard went into effect on September 16, 1997. It established a three-year baseline data collection period that was completed in 2000. The 1-hour ozone standard is used in the Gulf of Mexico Air Quality Study (SAI, 1995). This 1-hour ozone standard will still apply to those areas that have not achieved the 1-hour standard. The 8-hour ozone standard will apply everywhere else. Therefore, a new ozone analysis is needed as soon as possible after the 2000 emission inventory is collected to allow the States to prepare and submit their air pollution control plans to the U.S. EPA in the year 2003.

Revised date: 11/7/2001

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDY PLAN FY 2002-2004

Region: Gulf of Mexico OCS Region

Planning Area(s): Gulfwide

Type: Competitive Procurement

Title: Satellite Remote Sensing Data Retrieval in the Gulf of Mexico Region

Period of Performance: FY 2003-2004

Description:

Background Routine meteorological data observations are very sparse, or near non-existence in the Gulf of Mexico Region. Yet these data are crucial for improving air quality and meteorological modeling systems. They are needed to serve as input data for model simulations, e.g., the initial and boundary conditions. The accuracy of the model outputs strongly depends on the observational data. The satellite remote sensing can be utilized to fill this data gap. The satellite data can be used to retrieve the useful meteorological data for model simulations. For instance, the Advanced Very High Resolution Radiometer (AVHRR) is on board the NASA polar orbiting satellite with 1-Km spatial resolution in five wavebands. This capability can be used for monitoring of surface and atmospheric conditions. These data can be used to produce analysis field for numerical modeling or air quality such as fire and smoke. The satellite remote sensing can provide useful information on sea State and atmospheric conditions and characteristics, which can be utilized to derive the meteorological variables such as wind, temperature, moisture and sea surface temperature.

Objectives The objectives of this study are: 1) to demonstrate the feasibility and capability of the satellite remote sensing for retrieving the meteorological variables and sea State conditions for improving air quality or meteorological modeling system; 2) to understand the atmospheric process such as sea-breeze circulation in the coastal region in the Gulf of Mexico Region; 3) to define the sea State and the State of atmospheric conditions and to collect the available data from various sources for the purpose of demonstration; 4) to make comparisons with the observational data; and 5) to make recommendations for the future study regarding the capability of using remote sensing data.

Methods Use satellite remote sensing techniques to derive the atmospheric State or sea State variables and characteristics for improving air quality and meteorological modeling systems.

Products A final report.

Important to MMS Routine meteorological observations to define the vertical structure of the atmospheric conditions are practically non-existence in the Gulf of Mexico Region, especially in the deepwater environment. MMS urgently needs these data for improving air quality and meteorological modeling systems or to assess the environmental impacts of the offshore operations on coastal air quality. The data can also be used for oil spill applications.

Data Information Required: There is an urgent need of this data in the next few years to gain a deeper understanding of the atmospheric process and to define the State of atmospheric conditions and sea State for air quality modeling. The data are needed for improving the air quality modeling such as NO_x and SO_x and ozone formation as well as assessing the environmental impacts from the oil and gas operations in the Gulf of Mexico Region.

Revised date: 11/7/2001

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDY PLAN FY 2002-2004

Region: Gulf of Mexico OCS Region

Planning Area(s): Gulfwide

Type: Competitive Procurement

Title: *Deepwater Program: Methane Hydrates in Ultra Deepwater*

Period of Performance: FY 2003-2005

Description:

Background Gas hydrates are cage-like structures of water with methane or other small gas or hydrocarbon molecules entrapped that form under low temperature and high pressure conditions. Scientists have observed outcrops of hydrates along the continental slope in the Gulf of Mexico. In addition, piston core data indicates many locations of shallow hydrates. Recovery of this hydrate may pose a hazard by causing slope instability, were they to be extracted for their natural gas content. However, hydrates in ultra deepwater (> 1000m) are found on the continental rise, where topography is not very steep. Pressure and temperature conditions are well within the hydrate stability zone, and potentially concentrated, and therefore economically attractive, accumulations of hydrates may occur. A more detailed understanding of the location and extent of hydrates is necessary before an Environmental Assessment can be done.

Of greatest interest are locations in Mississippi Canyon and Atwater Blocks. Numerous piston cores have been collected from this region and greater than 50 percent indicate subsurface hydrates. To date, outcrops of hydrate have not been observed, but that does not preclude their existence. This region represents the most attractive potential location for hydrate extraction in the Gulf of Mexico and therefore warrants further investigation.

Objectives The objective of this study is to increase the understanding of the distribution of methane hydrates in the ultra deepwater areas of Mississippi Canyon and Atwater Blocks

Methods The methods used would include identification of the most probable location of hydrate outcrops and investigation with the submersible, Alvin and piston coring in a systematic grid pattern to delineate the subsurface distribution of methane hydrates.

Products A final report.

Importance to MMS The MMS can use the information as indications of hydrocarbon bearing formations for resource evaluation and also to make improved estimates of the extent of gas hydrates as a resource. This will enable the focused preparation of an Environmental Assessment of the extraction of natural gas from hydrates.

Date Information Required: The information is needed to assist in the understanding of the distribution of hydrates to determine the focus of an Environmental Assessment.

Revised date: 11/7/2001

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDY PLAN FY 2002-2004

Region: Gulf of Mexico OCS Region

Planning Area(s): Gulfwide

Type: Competitive Procurement

Title: *Deepwater Program: Verifying Methane Hydrate on the OCS*

Period of Performance: FY 2003-2005

Description:

Background Gas hydrates are cage-like structures of water with methane or other small gas or hydrocarbon molecules entrapped. Estimates of the quantities of methane (natural gas) that may be recovered from hydrates exceeds present known reserves of natural gas. As society consumes the other sources of natural gas, recovery from methane hydrates becomes increasingly attractive and economical. On the OCS, gas hydrates occur naturally within the sediments and on the surface. Methods for the recovery of hydrates are being developed and tested in Japan. The possibility of the exploitation of hydrates in the Gulf of Mexico is becoming a greater reality. Before this can be accomplished, additional information is needed as to the distribution and density of hydrates presently in the Gulf. The preparation of an Environmental Assessment will require information about the location of the hydrate and the process of removal. The first question that needs to be addressed is whether economical reservoirs of hydrate exist in the Gulf.

Thus far, seismic data has been the primary resource for identifying and quantifying hydrate reserves. In the Gulf of Mexico, this has been very difficult or impossible to do because of the complex geologic environment. A few hydrate outcrops have been identified, but the subsurface extent of the hydrates has not been determined. The MMS has available 3D seismic surface anomaly data, which extends over significant areas of the continental slope. It is not known whether this is due to hydrates or some other reflective material such as carbonates, sands, etc. Another study, presently funded by MMS, is ground-truthing the surface expressions of the anomaly data and has already found that hydrate outcrops at the surface are rare. Several locations have sediment covering the anomaly, making identification impossible. Verification by core samples is the only way to determine whether hydrate is responsible for the surface anomalies. Conventional piston cores sample the top 6-20 meters, while hydrate could extend much deeper. The Ocean Drilling Program has drilled on the Blake Plateau in the Atlantic to collect cores with hydrate several hundreds of meters below the surface. Their ability to drill to great depths would be invaluable to understanding the extent of hydrates in the Gulf and the potential for the economical recovery of natural gas from them.

This study will obtain cores to verify the seismic information available to MMS. The Ocean Drilling Program (ODP) may visit the Gulf of Mexico in 2002, specifically to drill for gas hydrates. The program has tremendous ancillary facilities to supply geological and geochemical information about the cores, which are funded by the core program. Relating the coring data to the seismic data will enable the MMS to improve the ability to identify hydrates from seismic

data thus enhancing evaluations of hydrate location and identifying where an Environmental Assessment may be required.

Objectives The objectives of this study are to: 1) improve the ability to identify hydrates from surface anomaly data and 2) determine the true extent of the gas hydrate resource.

Methods Cores will be collected from sites selected by MMS during a leg of the Ocean Drilling Program. The MMS Contractor will identify gas hydrates in the cores and relate this information to seismic data from the same area.

Products A final report.

Importance to MMS The MMS can use the information as indications of hydrocarbon bearing formations for resource evaluation and also to make improved estimates of the extent of gas hydrates as a resource. This will enable the focused preparation of an Environmental Assessment of the extraction of natural gas from hydrates.

Date Information Required: The Ocean Drilling Program may bring the JOIDES Resolution to the Gulf of Mexico in the near future to specifically core gas hydrate deposits. This study would take advantage of this opportunity to collect the cores necessary to verify the 3D seismic anomaly data.

Revised date: 11/7/2001

SECTION 3.

3.0 Topical Areas for FY 2004

The GOMR is expecting a continuation of the increase in offshore oil and gas activities it is currently experiencing. Issues that may result in future studies include industry's accelerated move into deepwater; platform removals (including rigs-to-reefs issues); biotechnology; invasive species; and understanding the chronic sublethal impacts associated with offshore development and production, that is, fates and effects. The GOMR is also anticipating an increased interest in new activities along the Atlantic Coast.

3.1. Deepwater

Deepwater habitats are the least understood marine environments of the Gulf of Mexico. Several major deepwater studies were initiated in 2000 to broaden our limited knowledge base of the benthic ecology. There is also growing evidence that deep-sea corals are foundation species for their associated biological communities and that these communities are inadequately conserved, partly as a result of lack of information on the importance of these corals. Deep *Lophelia* reefs are currently being studied off the coast of Scotland with reference to their sensitivity to oil and gas activities.

The study of chemosynthetic communities in the northern Gulf of Mexico has essentially been limited to water depths of less than 1000 m due to limitations and availability of research submersibles. With the capabilities for oil and gas exploration and development now extending into the deepest parts of the Gulf of Mexico (3,800 m), the future of chemosynthetic community research should also proceed into those depths. There has been some progress in correlating acoustic geophysical signals with the potential existence of communities but this method remains imprecise. A study of how major and persistent seeps correlate with high density chemosynthetic communities could be performed throughout the entire depth range of the Gulf using now readily available deep-water ROVs. A program to utilize the only manned submersible capable of reaching 3000 m depths (*Alvin*) could also be a major component of a new initiative to fully understand the association of thriving communities and seeps below 1000 m. A broader general objective would be the discovery, description, and understanding of deep chemosynthetic communities.

3.2. Platform Removal

In the Gulf of Mexico, retired platforms are either taken ashore to be reused and recycled or turned over to a State for use in its artificial reef program. Platform removal and disposal will continue to present challenges to the MMS. Initial study efforts concentrated on the impact of explosive platform removals on marine mammals and turtles and, more recently, to fisheries resources. However, the next ten years will see an accelerated rate of removal leading to questions concerning the dismantling of the world's largest artificial reef system.

A number of studies investigating the biological/ecological nature of standing structures are currently being conducted through the GOMR CMI. These are providing information on the abundance and distribution of key species, and the survival and recruitment of juvenile and larval fishes at platforms. More recently, discussions between MMS and its coastal State partners have identified “partial” removals and the “value” of the artificial reef effect in deepwater as issues that need to be resolved. Thus, as lease abandonment activities continue, artificial reef programs expand, and the industry continues its development of deepwater leases, MMS will be required to expand its knowledge base regarding platform removals.

3.3. Bioprospecting on OCS Platforms

Presently, MMS, in partnership through the CMI with LSU and the University of California - Santa Barbara, is developing several studies to examine the availability and distribution of bioharvestable marine organisms that occupy OCS platforms and chemosynthetic communities. Concerns for continued overall protection of chemosynthetic communities and the levels of sustainable harvest of platform community components will be a component in the development of these potential new resources. One day soon the search for oil and gas on the OCS will be joined by the search for genetic and biochemical resources found in marine organisms growing on platforms and in chemosynthetic communities. This "bioprospecting" or "biomining" may produce new therapeutic drugs for fighting cancer, AIDS, or heart disease. Many of DOI's bureaus are coming to terms with the possibility of locating, conserving, and licensing the natural products of their trust resources. MMS has had a long history of studying the ecology of platforms. As part of these studies, many species of algae, hydroids, sponges, and barnacles have been identified with several candidates producing therapeutic natural products. One candidate organism, the bryozoan, *Bugula neritina*, lives in the Gulf and potentially can be commercially harvested from platforms. This organism produces a chemical, Bryostatin 1, which is in Phase II trial testing as a treatment against non-Hodgkin's lymphoma and chronic leukemia. If the platforms can be shown to be a ready source for this organism, then MMS may be dealing with this emerging issue in a significant way.

3.4. Invasive Species

Invasive species (meaning not native to but arriving, establishing, and spreading) are introduced into the Gulf of Mexico as: 1) fouling and boring organisms on semi-submersible exploratory drilling rigs originating from locations outside the Gulf; 2) encrusting fouling, and boring species on artificial reef material towed into the GOM from another area; 3) fouling and boring organisms on ships; 4) organisms contained in ballast seawater from ships; 5) imports of live shellfish sold in seafood markets; and 6) non-native fisheries introductions.

Oil and gas platforms are facilitating the range extension of several species (the barnacle *Tetraclita stalactifera stalactifera*, the yellowtail snapper *Ocyurus chrysurus*, the brown mussel *Perna perna*). The platforms, used as “stepping stones”, are allowing native and invasive species to be introduced to new places, which could cause significant changes in

the ecological roles of each of these species. The Australian spotted jellyfish, *Phyllorhiza punctata*, was seen in tremendous concentrations during the summer of 2000 as was another invasive jelly, *Drymonema dalmatina*. Both of these invasive species appear to have come into the Gulf from Caribbean waters. These unusually high jellyfish densities raise a number of concerns. Fishermen have experienced damage to equipment due to large numbers of jellies in their nets. The jellyfish are very efficient filter feeders and their primary food source is plankton. The jellyfish concentrations were in prime locations to feed on the planktonic larvae and eggs of shrimp, crabs and many important fish species that spawn offshore as they drifted on the currents to inshore nursery areas of the Sound. The role of artificial structures and reefs in enhancing the abundance of invasive species will continue to be an area of interest.

3.5. Fates and Effects Studies

The OCS supports large and valuable commercial and recreational fisheries, and concern has been expressed that the oil and gas industry may contaminate these resources or the supporting ecosystem. Understanding the chronic, sublethal impacts that may be associated with offshore oil and gas activities is a concern to many. Questions continually arise as industry moves into deeper water and applies new technology. The studies program is continuously addressing the information needs in this constantly evolving area and will develop new studies as the need arises.

3.6. Atlantic Studies

With the increased concern about meeting future energy needs, the Atlantic OCS may again be looked to as a potential resource. We are presently conducting a literature search and synthesis on existing information in the Mid- and North Atlantic Planning Areas. Information needs will be identified once this synthesis is completed.

SECTION 4.

4.0 Literature Cited

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